1 **(a) (i)** lower <u>concentration</u> [1]
ACCEPT without reference to experiment 2
but higher concentration must be referred to expt 1
COND fewer collisions **or** lower rate of collision [1]

(ii) powdered so <u>larger surface area</u> [1]
COND so more collisions **or** higher rate of collisions [1]

(iii) higher temperature particles move faster
or more particles have enough energy to react **or** have more energy
or more particles have Ea [1]
COND collide more frequently
or more particles have energy to react
or more collisions result in a reaction [1]
NOTE for conformity faster collisions = rate of collisions

(b) (i) from origin [1]
gradient decreases until = 0 [1]
therefore has to be a curve

(ii) mass of one mole of $CaCO_3$ = 100
number of moles of $CaCO_3$ = 0.3/100 = 0.003 [1]
moles of HCl = 5/1000 x 1 = 0.005 [1]
reagent in excess is $CaCO_3$ [1]
ecf from above
would need 0.006 moles of HCl
or hydrochloric acid only reacts with 0.0025 moles of $CaCO_3$ [1]
NOTE this mark needs to show recognition of the 1:2 ratio

(iii) mark **ecf** to **(ii)**, that is from moles of limiting reagent in **(ii)**
moles of CO_2 = 0.005 x 0.5 x 24 = 0.06 dm^3 [1]
NOT cm^3 unless numerically correct. 60 cm^3
Ignore other units
NOTE If both number of moles integers then no ecf for **(ii)** and **(iii)**

[Total: 13]

2 **(a)** limestone **or** marble **or** chalk or coral or calcite or aragonite [1]

(b) 100 [1]
56 ignore units in both cases [1]

(ii) 7.00kg is 1/8 of 56 [1]
1/8 of 100kg is 12.5kg [1]
Give both marks for correct answer without explanation. Ignore missing units but penalise wrong units

(c) Any reasonable explanation
Plants prefer soil pH about 7
Plants do not grow (well) in acidic soils/plants grow better
To increase crop yields
Any **ONE** [1]
Do **NOT** accept in acidic soils plants die

(ii) With calcium carbonate, pH cannot go above 7 [1]
It is not washed away by the rain/remains longer in the soil
It is not absorbed by the plant [1]
OR
With calcium oxide, pH can go above 7 [1]
It is washed away by the rain [1]

(iii) Any correct use - making steel/iron, making cement, making glass, disposing of acid wastes, removing sulphur dioxide from flue gases, (stone in) building, indigestion tablets, toothpaste, cosmetics etc [1]

[TOTAL = 9]

Question	Answer	Marks
3(a)(i)		**1**
(a)(ii)		**1**
(a)(iii)		**1**
(a)(iv)		**1**
(a)(v)		**1**
(b)(i)	air;	**1**
(b)(ii)	iron;	**1**
(b)(iii)	any 2 from: carbon dioxide; carbon monoxide; nitrogen;	**2**
(c)(i)	as the percentage of carbon increases, so the malleability decreases;	**1**
(c)(ii)	 **M1** oxygen (gas) blown in; **M2** carbon dioxide formed / $C + O_2 \rightarrow CO_2$;	**2** 1 1

Question	Answer	Marks	Guidance
4(a)	*Forming an oxide* (all) elements or (all) impurities become oxides; M2 *Gaseous oxides* carbon dioxide or sulfur (di)oxide escape / are removed as gases; M3 *Acidic oxides* silicon(IV) oxide or phosphorus(III / V) oxide react / are neutralised by calcium oxide / lime; M4 *Equation mark* any one of the following equations $S + O_2 \rightarrow SO_2$; $C + O_2 \rightarrow CO_2$ or $2C + O_2 \rightarrow 2CO$; $Si + O_2 \rightarrow SiO_2$; $4P + 5O_2 \rightarrow 2P_2O_5$ or $P_4 + 5O_2 \rightarrow 2P_2O_5$; $4P + 3O_2 \rightarrow 2P_2O_3$ or $P_4 + 3O_2 \rightarrow 2P_2O_3$; M5 *Word equation mark* any one of the following word equations calcium oxide + silicon(IV) oxide → calcium silicate; calcium oxide + phosphorus(III / V) oxide → calcium phosphate;	**5**	(All) elements or (all) impurities react with oxygen **A** M1 for any one element becoming an oxide **A** formulae / carbon monoxide **A** oxides of sulfur / carbon **I** sulfur trioxide **A** silicon (di)oxide for silicon(IV) oxide **A** phosphorus (tri/pent)oxide for phosphorus(III / V) oxide **A** multiples **I** state symbols **I** unbalanced equations **R** other combustion equations with incorrect species **A** calcium oxide + silicon(IV) oxide → slag **A** correct symbol equation for M5 but **R** other equations with incorrect species used as M5

Question	Answer	Marks	Guidance
4(b)(i)	*Any **one** from:* (making) car (bodies); machinery; chains; pylons; white goods; nails; screws; as a building material; sheds / roofs; reinforcing concrete;	**1**	**A** bridges **A** tools **I** cutlery
(b)(ii)	*Any **one** from:* knives; drills; railway tracks; machine / cutting tools / hammers; razor blades; chisels;	**1**	**I** cutlery items **I** bridges
(b)(iii)	M1 atoms or cations or (positive) ions or metal ions; M2 arranged in a lattice or in layers or in rows or in a regular structure; M3 rows or layers slide over one another;	**3**	**I** (sea of) electrons **R** protons or nuclei for M1 **A** M2 non-directional forces **A** ECF on particle named in M1 for M3 **I** 'atoms' slide over one another
(b)(iv)	carbon **atoms** or **particles** in structure different size (to cations); M2 so reduce moving or interrupt movement;	**2**	**R** ions and molecules for M1 **A** M2 for prevents sliding **A** M2 for 'stops' sliding